

Groundwater Assessment Demonstration Report

for

Operating Company: Appalachian Power Company

Facility: John E. Amos Plant

Location: St. Albans, West Virginia

I hereby certify that I have examined data regarding the facility and, being familiar with the provisions of 40 CFR, Part 265.9, I attest that this Groundwater Assessment Demonstration Report has been prepared in accordance with good engineering practices.

Robert Haag, Geologist

Printed name of qualified geologist or geotechnical engineer

Robert Haag
Signature of qualified geologist or geotechnical engineer

Date 11/10/81

Designated person accountable for RCRA activities at this facility:

Name and Title Thomas W. Worstell, Supervising Performance Engineer

Designated Company Contact:

Name and Title R. E. Northup, Environmental Affairs Director

Address P.O. Box 2021, Roanoke, VA 24022

(703) 985-2429

Groundwater Assessment Demonstration Report

for

John E. Amos Plant

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I. Statement of Facility Policy and Objectives

Through safe and conscientious handling of on-site hazardous wastes regulated under the Resource Conservation and Recovery Act (RCRA), this facility is committed to preventing contamination of groundwaters. Toward that end, this document has been prepared to:

- 1) examine hazardous waste(s) managed on-site and/or discharged to on-site impoundment(s),
- 2) examine potential(s) for those hazardous waste(s) to migrate via the uppermost aquifer to water supply wells or to surface waters, and
- 3) to determine if installation, operation and maintenance of an on-site groundwater monitoring system is necessary.

This Groundwater Assessment Demonstration Report satisfies the written requirements set forth in 40 CFR, Part 265.90, paragraph (c). At a minimum this report, which will be kept at the facility, addresses the following items:

- 1) The hazardous wastes handled at this facility
- 2) The potential for migration of hazardous waste or hazardous waste constituents from the facility to the uppermost aquifer, by an evaluation of:
 - a) a water balance of precipitation, evapotranspiration, runoff, and infiltration, and
 - b) unsaturated zone characteristics (i.e., geologic materials, physical properties, and depth to groundwater), and
 - c) the potential for hazardous waste or hazardous waste constituents which enter the uppermost aquifer to migrate to a water supply well or surface water, by an evaluation of:

- i) saturated zone characteristics (i.e., geologic materials, physical properties, and rate of groundwater flow), and
- ii) the proximity of the facility to water supply wells or surface water.

If this Demonstration Report, when completed, shows that groundwater monitoring is not necessary, then the report will be kept available during interim status and provided to the Regional Administrator upon his request. Should the completed Report show that groundwater monitoring is necessary, then the Report will serve as the rationale for monitoring well placements. If shown to be necessary, groundwater monitoring must begin by November 19, 1981; a groundwater sampling and analysis plan would have to be prepared by that same date, as would an outline of a groundwater quality assessment program. These additional requirements are mentioned here only for informational purposes. The primary objectives of this Groundwater Assessment Demonstration Report are as already given in the first paragraph of this section.

II. Operational Description of the Facility and the Hazardous Wastes Handled On-Site

A. Operational Facility Description and Layout

A brief description of this Plant's generating capability and general site layout is given below. An abbreviated plot plan is attached to assist the reader in visualizing the facility layout.

Throughout this Report additional pages will be added as necessary and will be designated by the original page number followed by A, B, C, etc.

John E. Amos Plant is located in Putnam County in west-central West Virginia on the Kanawha River. Charleston is the closest major metropolitan area (1970 population 71,505) and is located about 15 miles to the southeast.

The Plant consists of three coal-fired steam electric generating units. Units 1 and 2 are rated at 800 MW each and Unit 3 at 1300 MW. Condenser cooling is a recirculating system using a natural draft, hyperbolic cooling tower on each unit. Bottom ash and pyrites from all three units and fly ash from Unit 3 are sluiced to separate on-site sedimentation ponds for treatment. Fly ash from Units 1 and 2 is disposed of utilizing a dry ash handling system and landfills. All three units are equipped with electrostatic precipitators.

II.A. Operational Facility Description and Layout, cont'd.

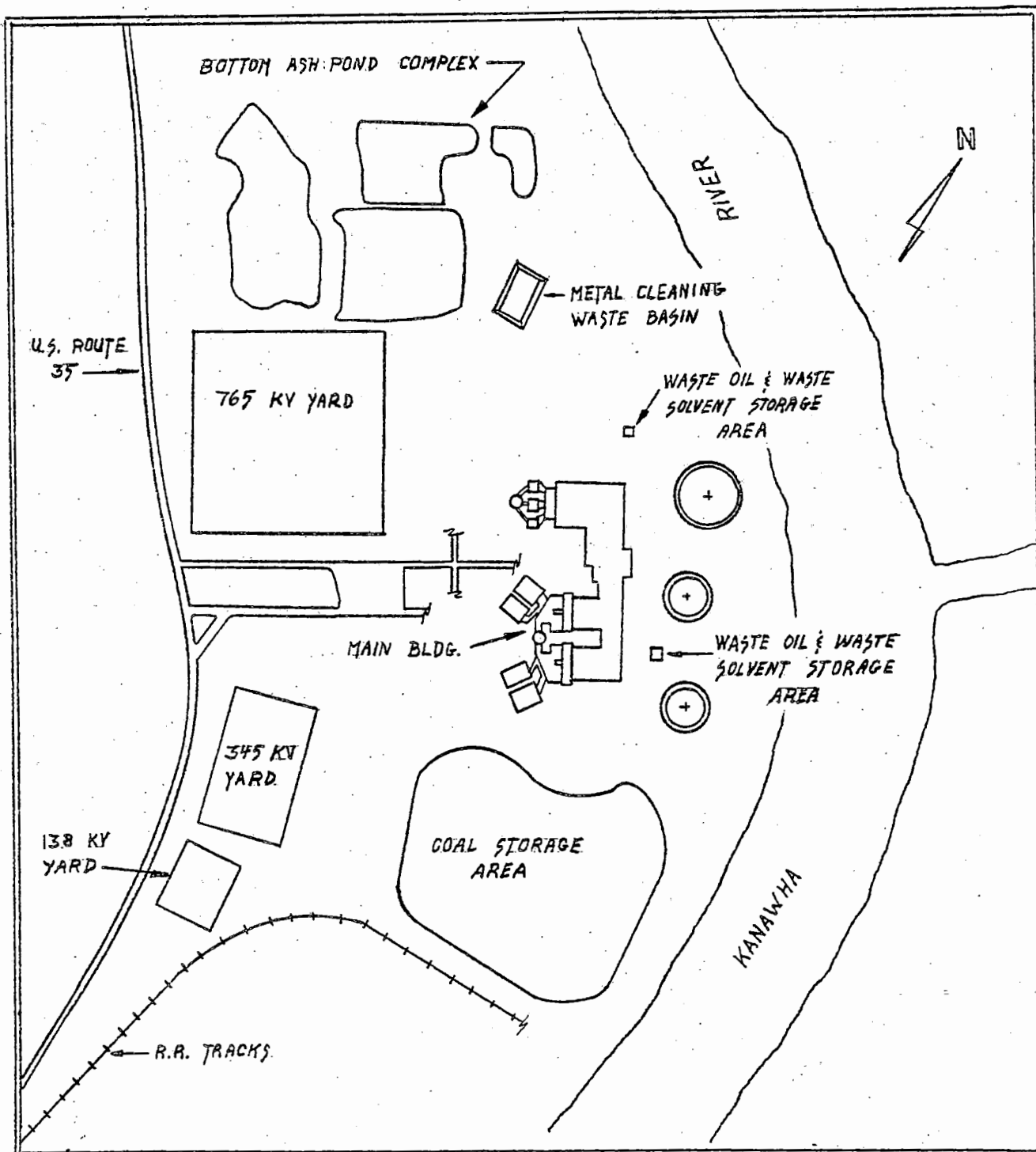
A RCRA permit application was filed for the Plant by APCo on November 13, 1980. (EPA I.D. No. WVT000621821). Hazardous wastes handled on-site will be more fully described in Parts II.B. and II.C. of this report, but they consist of metal cleaning wastes from the chemical cleaning of the boiler tubes and waste degreasing solvents. Metal cleaning wastes are discharged to the metal cleaning waste basin for treatment. Waste solvents are stored in two-400 gallon containers and/or two-55 gallon drums as shown on the abbreviated plot plan in Part II.A. (one drum and one container per site). These solvents are mixed with waste oil in the two larger containers and all are subsequently burned in the Plant's boilers for BTU value.

II.A. Operational Facility Description and Layout, cont'd.

Abbreviated Plot Plan

APPROX. SCALE 1" = 900'

AMOS PLANT



ARW 3-17-81

II.B. Listing of Hazardous Wastes Handled On-Site by Methods
Other than Surface Impoundment

Listed below are the hazardous wastes managed on-site by methods other than surface impoundment. Measures taken to assure that this group of hazardous wastes do not impact groundwater are given. For example, periodic inspection of a barrel stored on curbed asphalt and containing a hazardous waste solvent provides assurance that groundwater is not being impacted.

<u>Hazardous Wastes</u>	<u>Measures Taken</u>
<u>Trichloroethane</u> <u>(F001)</u>	<u>Waste trichloroethane is collected</u> <u>in a 55-gallon drum located at the sites shown on</u> <u>the abbreviated plot plan. Trichloroethane is used</u> <u>very infrequently at this facility and any waste would</u> <u>be burned for its BTU value as soon as possible.</u>
<u>Varsol-Stoddard Solvent</u> <u>(D001)</u>	<u>Waste varsol is accumulated in two-400 gallon</u> <u>portable containers. It becomes mixed with waste</u> <u>oil which is also accumulated in these containers.</u> <u>The waste mixture is periodically tested for hazardous</u> <u>characteristics.</u> <u>Should the tests prove the wastes to be hazardous,</u> <u>they would be burned for BTU value as soon as possible.</u>

II.B. Listing of Hazardous Wastes Handled On-Site by Methods:
Other than Surface Impoundment, cont'd.

Hazardous Wastes

Measures Taken

(please continue with the following page)

II.C. Listing of Hazardous Wastes Managed On-Site By
Surface Impoundment

Listed below are the hazardous wastes managed on-site by surface impoundment. Also provided is a column which explains how the waste was produced, what form of treatment (if any) is provided, and what chemical reactions are anticipated. Estimates of the detention times are provided as well as a description of the ultimate disposition.

Hazardous Wastes Discussion

Metal Cleaning Wastes

(D007)

During periodic waterside chemical cleanings of steam generator tubes, etc., a spent acid solution results. Generally, a 2% hydroxyacetic - 1% formic acid solution is used to clean each unit. The spent solution is discharged to a basin used only for the treatment of these wastes. Pulverized lime is added to the wastes in the basin followed by the addition of sodium hydroxide. These chemicals aid in raising the pH of the solution. By raising the pH, the solubility of iron and copper is greatly reduced allowing these metals and others to precipitate out to the bottom of the basin. Neutralization occurs quickly, and the waste is rendered non-hazardous in a brief period of time.

II.C. Listing of Hazardous Wastes Managed On-Site By
Surface Impoundment, cont'd.

<u>Hazardous Wastes</u>	<u>Discussion</u>
-------------------------	-------------------

	Prior to the addition of lime and caustic to
	elevate pH and precipitate metals, generally
	the metal cleaning waste is a hazardous waste
	solely due to total chromium concentrations
	exceeding 5.0 mg/l. For example, an EP toxicity
	test run on an Amos Plant metal cleaning waste
	showed a total chromium concentration of 7.17
	mg/l. The other metals in that particular test
	were below the U.S. EPA criteria for toxicity
	by at least one order of magnitude. However,
	depending on the condition of the tube metal
	being cleaned, total chromium may not exceed the
	criterion for chromium toxicity. A waste sample
	taken during the April 13, 1981 metal cleaning
	job at another similar plant showed that particular
	waste was nonhazardous with a total chromium
	concentration of 4.0 mg/l. An analysis of
	the same sample for hexavalent chromium concentra-
	tion showed less than 0.100 mg/l. If the rule
	proposed in the October 30, 1980 Federal Register
	becomes final (the rule to change the chromium

II.C. Listing of Hazardous Wastes Managed On-Site By
Surface Impoundment, cont'd.

<u>Hazardous Wastes</u>	<u>Discussion</u>
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	<u>toxicity criterion from total chromium to hexavalent</u>
	<u>chromium), then the Company would not be handling</u>
	<u>a hazardous metal cleaning waste at all. More speci-</u>
	<u>fically , we know that the Amos metal cleaning</u>
	<u>waste cannot be classified as a waste which is:</u>

	<u>a) reactive,</u>
--	---------------------

	<u>b) ignitable,</u>
--	----------------------

	<u>c) corrosive, by low or high pH or by corrosion</u>
	<u>rate,</u>

	<u>d) toxic, except when the total chromium con-</u>
	<u>centration exceeds 5.0 mg/l,</u>

	<u>e) a listed hazardous waste.</u>
--	-------------------------------------

	<u>After treatment of the metal cleaning waste the</u>
	<u>resulting liquid is held in the basin until the con-</u>
	<u>centration of iron and copper are below 1.0 mg/l</u>
	<u>(for NPDES purposes) and total chromium below 5.0 mg/l</u>
	<u>(for RCRA purposes). The supernatant is then decanted</u>
	<u>to the bottom ash pond.</u>

	<u>A closure plan, as dictated by RCRA, has been</u>
	<u>prepared outlining procedures to be followed to ensure</u>
	<u>an environmentally safe closeout of the basin. The</u>



III. Geological and Hydrological Description of the Facility

This section presents data gathered from various sources regarding the geologic and hydrologic makeup of the site and surrounding area.

III.A. Identification of Regional Flow Systems and Water Supply Sources in the Area

There are two principle sources of potable groundwater in the Amos Plant vicinity: the coarse, basal sand and gravel of the Kanawha River's Pleistocene valley-fill, and sandstone units in the Conemaugh group of the Pennsylvanian-aged bedrock. The Conemaugh group sandstones have so far had the greater development as sources of water supply, primarily due to the ease of well construction in sandstones. However, the sand and gravel Kanawha valley-fill supplies many industrial needs, and has the greater potential for future groundwater development.

Kanawha River Valley-Fill Aquifer. Prior to the Pleistocene glaciations, geological evidence indicates that the portion of the Kanawha River along which the Amos Plant is located carried water to the northwest, as it does today, but that this flow crossed the path of the present-day Ohio River. The Ohio River did not then exist in the Point Pleasant-Gallipolis region (Lamborn, 1954). South of the plant site, beginning at Scary, the present-day Kanawha channel belonged to the pre-glacial Teays River. The Teays River flowed directly westward from Scary, also crossing the path of the present-day

III.A. Identification of Regional Flow Systems and Water Supply Sources in the Area (cont'd.)

Ohio River (Cross and Schemel, 1956). However, the advance of glacial ice dammed up the northwestern reaches of both of these preglacial rivers, and meltwaters carrying large quantities of sand and gravel found a most convenient path to the Mississippi by joining many separate river segments to create the Ohio River. By the end of the glacial period, the Teays valley westward from Scary had been completely abandoned, and its flow was added to the reach of the Kanawha River which now extends north from Scary to join the Ohio River at Point Pleasant. Late in the glacial oscillations, however, the Ohio River and its tributaries were temporarily dammed. In the resulting slackwater period, a blanket of silt and clay was deposited over the coarser-grained river alluvium (Walker, 1957).

The result of this complex history is a fairly deep rock-cut channel created by the earliest "Kanawha" river. The channel is filled to a certain depth by sandy alluvium, which is finer than that filling the Ohio River, and is covered by a substantial deposit of silts and clays laid down under slackwater conditions. The aquifer created by the sand deposits in the bottom of the rock-cut channel will be unconfined if the water table falls below these "capping" silts and clays, but will be confined or semi-confined if the water table rises into the "capping" deposits. The latter condition is generally found upon drilling near the Amos Plant.

Although the Kanawha River valley-fill bears a resemblance to that of the Ohio River, its water-bearing deposits are roughly five times less permeable, averaging 450 gpd/ft² vs. 2,300 gpd/ft² for the Ohio. Industrial/

III.A. Identification of Regional Flow Systems and Water Supply Sources in the Area (cont'd.)

municipal wells placed in the Kanawha valley-fill yield in the range of 10-150 gpm, with an average of approximately 68 gpm (Wilmoth, 1966).

The geometry of the Kanawha valley-fill can be defined from the visible valley walls, and borings taken for the Amos Plant, as shown in Figures 1 and 2. The valley at this point is somewhat wider than its average, due to the confluence of the Pocatalico River across from the plant site.

The character of the valley-fill aquifer and its gradient have been well-defined by a study fortuitously performed at the present location of the Amos Plant (Wilmoth, 1966). A typical section of the valley-fill deposit at that location appears as follows:

<u>Depth (feet)</u>	<u>Thickness (feet)</u>	<u>Description</u>
0-30	30	— lenticular clays and silts
31-48	18	— fine to coarse sand, local gravel
49-56	8	— gravel, some sand
Below 56		— bedrock of Conemaugh group

Fourteen wells were placed in this area for monitoring of the groundwater potential surface, the average configuration of which is shown in Figure 3. This figure displays the characteristic configuration for groundwater in an alluvial deposit that recharges a river; that is, with the gradient directed toward the river and having a slight downstream component. The

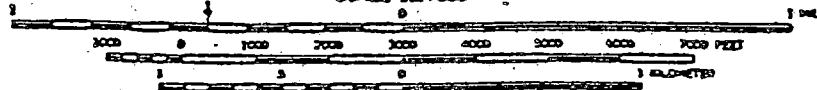


JOHN E. AMOS PLANT

USGS Maps:

SCALE 1:24000

Saint Albans Quadrangle
Bancroft Quadrangle
Depot Quadrangle



Contour Interval 20 Feet

(S) - Indicates Storm Water Outfall



QUADRANGLE LOCATION

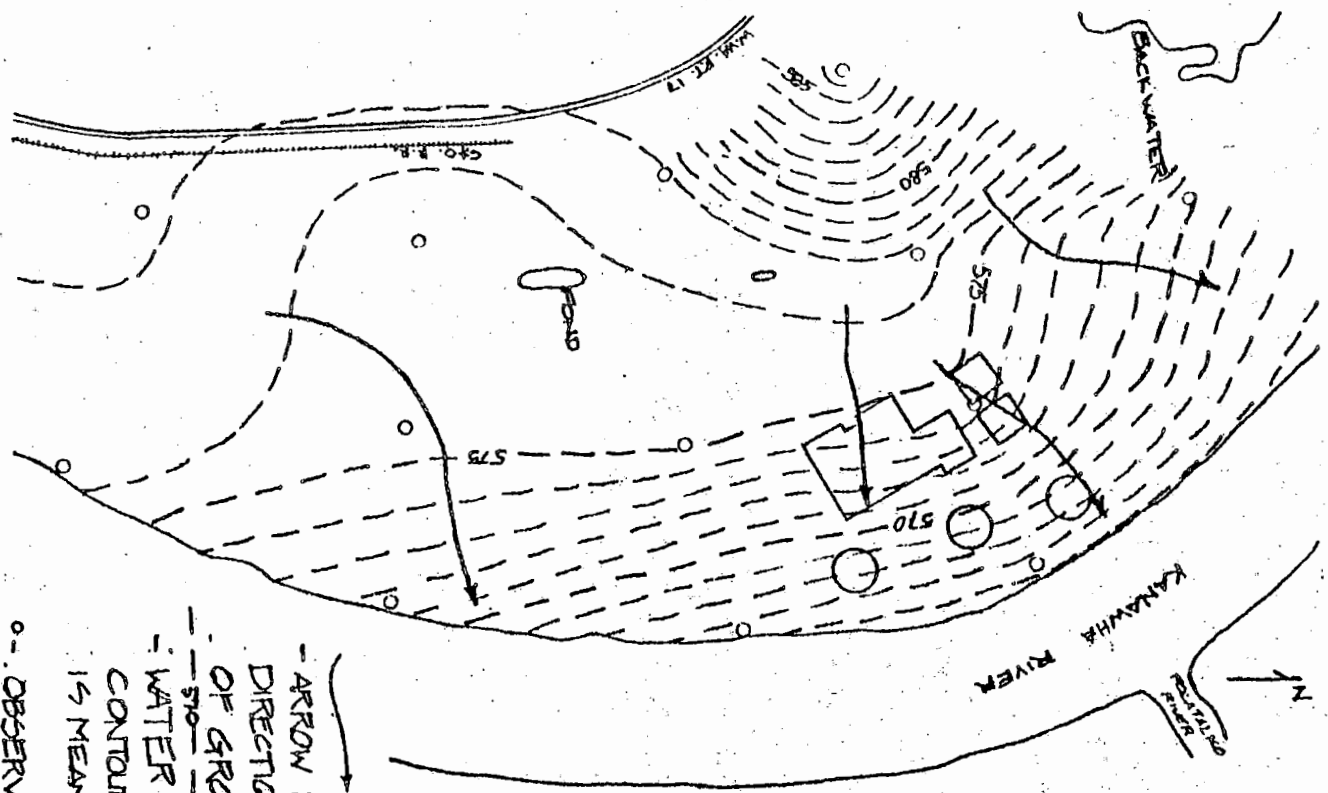
UTM GRID AND 1983 DATUM

Figure 2

Geologic Cross Section

(Please refer to the pocket at the rear of this report.)

GROUND WATER-MASON+PUTNAM COUNTIES



- ARROW INDICATES
DIRECTION OF MOVEMENT
OF GROUND WATER.
- 570 -
- WATER LEVEL CONTOUR
CONTOUR INTERVAL 1 ft. DATA
IS MEAN SEA LEVEL, JUNE 1966
- OBSERVATION WELLS

FIGURE 3 - WATER-LEVEL CONTOUR MAP
OF ALLUVIUM NEAR AMOS PLANT (AFTER
WILMOTH, 1966).

III.A. Identification of Regional Flow Systems and Water Supply Sources in the Area (cont'd.)

study indicated that the seasonal fluctuation of this potential surface is less than five feet, and determined a representative flow rate in the aquifer of 1.2 feet/day. Groundwater flow on the opposite side of the river would be similar, causing the river centerline to become an effective "groundwater barrier". At this point the subsurface waters must either enter the river, or turn downstream. The locations of nearby drinking water wells are shown in Figure 1. Rather than analyze in detail the relationships between these wells and the metal cleaning waste pond, this study applies a simpler and more conservative approach: should the available data indicate that hazardous waste constituents would be likely to reach the valley-fill aquifer at any point, then either groundwater monitoring or pond improvement will be recommended.

Bedrock Aquifers. The Pennsylvanian-aged Conemaugh group is the principle bedrock aquifer of this area, although it is possible that some wells may tap the Upper Pittsburgh sandstone found in the lower part of the Monongahela group, which overlies the Conemaugh group. The upper portion of the Conemaugh group are exposed in the lower parts of the hills surrounding the Amos Plant vicinity (Cross and Schemel, 1956), and the Conemaugh beds extend downward to achieve a total thickness ranging between 480 to 605 feet (Wilmoth, 1966). The deeper units of the Conemaugh group need little consideration, as salty groundwater occurs at depths of about 300 feet beneath the major rivers of this area (Wilmoth, 1975). The Conemaugh group is composed of cyclothems, which are repetitive sequences of sand-

III.A. Identification of Regional Flow Systems and Water Supply Sources in the Area (cont'd.)

stone, shale, limestone and coal. Many of these units do not produce water; however, several thick sandstones do provide a good supply, due to a combination of interstitial pores and fractures. For the entire group, the peak yield is 100 gpm, while the average is 9 gpm. The greatest yields come from coarse sandstones like the Buffalo and Mahoning at the base of the group; however, these two units have been known to yield salty water.

The general geologic structure of the area is characterized by a gentle northwestward dip toward the Parkersburg syncline. There is localized folding along parallel axes which puts "ripples" in the generally northwest-dipping rocks. These fold axes are shown in Figure 4. Subsurface flow in regional bedrock aquifers will be generally toward the synclinal axes. There may also be a component in flow in the bedrock parallel to the river, due to the presence of increased weathering and jointing there.

Interconnections of Aquifers. Wells in the Conemaugh group finish at many different elevations. Based on data in Wilmoth's report (1966), there appear to be four zones of the bedrock tapped by wells near the Amos Plant:

- 1) wells completed above the Kanawha valley-fill, above elevation 600 ft.,
- 2) wells completed in the same elevation range as the Kanawha valley-fill, between elevations 535 ft. and 570 ft.,

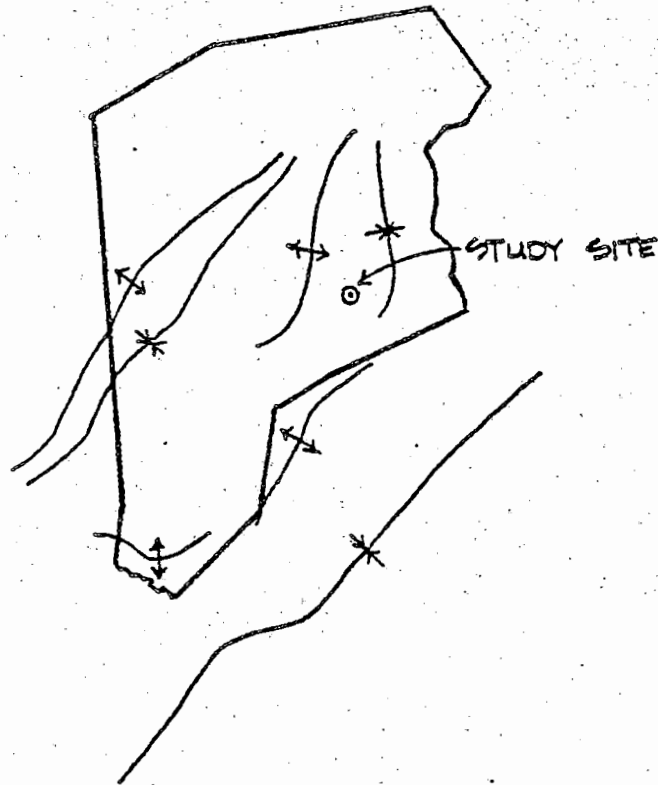
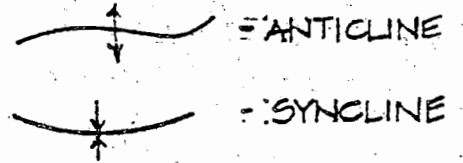


FIGURE 4:

GEOLOGIC STRUCTURAL TRENDS
PUTNAM COUNTY, WEST VIRGINIA.
(AFTER CARDWELL et. al, 1968)

III.A. Identification of Regional Flow Systems and Water Supply Sources in the Area (cont'd.)

3) wells completed about 20 feet below the Kanawha
bedrock channel, between elevations 495 ft. and 515
ft., and

4) wells completed about 45 feet below the Kanawha
bedrock channel, between elevations 470 ft. and 490 ft.

Wells in Zone 1, above the valley-fill, surely have no inter-
connection with it. Wells in Zone 2, however, most likely do have some
hydraulic connection with the valley-fill aquifer. Wells in Zones 3
and 4 probably do not have too great a connection with the valley-fill
aquifer, although the potential exists via fractures.

III.B. Identification of Facility Position Within the Regional
Flow System

As illustrated in the plot plan and Figure 2, the Amos Plant metal cleaning waste pond is located above the Kanawha River valley-fill aquifer, roughly 1,000 feet from the river. The pond was constructed by excavating and berming clayey material obtained from the vicinity, and is underlain by approximately 25 feet of similar, naturally-deposited materials, as further described in section III.C.

III. C. Metal Cleaning Waste Pond Engineering and Construction History

The MCW pond was designed and constructed during 1976, at the time modifications were being made to the bottom ash pond complex. The MCW pond is, however, a separate unit not connected to the bottom ash ponds. The MCW pond was designed to have a bottom elevation of 575 ft., with dikes cresting at elevation 585 ft. Because the natural ground surface at the site ranged from elevation 580 ft. to 584 ft., the pond consists of an excavation ranging between 5 ft. and 9 ft. in depth, and dikes ranging between 1 ft. and 5 ft. in height.

Near to the location of the MCW pond, the top of the artesian sand and gravel aquifer ranges between elevations 540 ft. and 550 ft., thus the distance from the bottom of the MCW pond to the top of the aquifer ranges between 25 ft. and 35 ft.

No significant problems concerning either the construction or operation of this metal cleaning waste pond have been documented, and it is believed that the pond is a sound one.

III.D. Inspection of Water Losses from the Facility to the Regional Flow System

Water which seeps from the metal cleaning waste pond may travel downward at an extremely slow rate through the clayey deposits below. Should such water finally leave these clayey deposits, hydrologic principles indicate that its path will turn sharply toward the river, travelling fairly close to the top of the sand and gravel aquifer, until it at last reaches and recharges the river. Waste constituents which are borne with the water's flow will follow the same path.

Waste constituents which are heavier than water, and which retain a density discrete from that of the surrounding fluid, would travel under the influence of both gravity and the groundwater gradient. Such constituents, after leaving the clayey deposits, would take an uncertain path toward both the river and the bottom of the rock-cut channel. Due to the higher permeability of the sand and gravel, most of such constituents would be likely to remain in this unconsolidated aquifer, travelling toward the river and then downstream below the river bottom. Some smaller portion of a heavy constituent would probably enter the Zone 2 bedrock aquifer, to travel in a downriver direction along river-parallel fracture traces. Contamination of units deeper still, though not impossible, is likely to be insignificant or nonexistent.

IV. Conclusion on the Impact of Leakage to Water Supply Sources and the Need for Monitoring Wells

Before offering geotechnical conclusions on the need or lack of need for groundwater monitoring at this facility, characteristics of the metal cleaning wastes periodically impounded must be emphasized. Characteristics of these wastes are such that they soon may be exempt from the hazardous waste regulations. A U.S. EPA regulation proposed on October 30, 1980, if adopted, would provide a basis for delisting the waste.

The metal cleaning wastes periodically handled at this facility are currently classified as hazardous wastes solely due to their total chromium concentrations. Sometimes analyses of these wastes show total chromium concentrations greater than the U.S. EPA criterion of 5.0 mg/l. Depending on the condition of the tube metal being cleaned, the total chromium concentration may be above or below the U.S. EPA limit.

Additional analyses of the metal cleaning wastes by the Company have shown that although the total chromium concentrations may be high (up to 15 mg/l), the hexavalent chromium concentrations are low. From four AEP samples of hydroxyacetic formic acid metal cleaning waste sludges or supernatants analyzed for hexavalent chromium, none has been higher than <0.100 mg/l. As stated by U.S. EPA in their proposed rule of October 30, 1980, hexavalent chromium is the valence state of concern because of its carcinogenic toxicity. Recognizing this fact U.S. EPA proposed to change the EP toxicity limit from total chromium (5.0 mg/l) to hexavalent chromium (5.0 mg/l). Should this rule become

IV. Conclusion on the Impact of Leakage to Water Supply Sources
and the Need for Monitoring Wells (cont'd.)

final, as we expect, the Company would no longer be handling a RCRA
hazardous waste in a surface impoundment and would, therefore, be
exempt from RCRA groundwater requirements. It is asked that the
following geotechnical conclusion be considered in light of the
potential change in regulations.

The presence of approximately 25 feet of clayey deposits
overlying the valley-fill aquifer will cause the movement of water from
the pond to the aquifer to be extremely small in quantity and slow in
velocity. During such slow travel, there exists a substantial
opportunity for the attenuation of the waste constituent concentration
through ion exchange with clay minerals. Upon reaching the sand and
gravel aquifer, remaining waste constituents would probably face
considerable dilution and dispersion. It is therefore rather unlikely
that a monitoring system placed in any of the area's principle aquifers
would be capable of detecting contamination from the metal cleaning waste
basin. Since such a monitoring system would be unlikely to provide
any benefits in protecting the groundwater of the region, such an
installation cannot in good conscience be recommended.

V. Review and Demonstration of How the Federal Guidelines on Required Contents of a Groundwater Assessment Demonstration Report Have Been Satisfied

Within earlier sections of this report, the Company addressed the potential for migration of hazardous waste or hazardous waste constituents from the facility to water supply wells (domestic, industrial, or agricultural) or to surface water. This material was presented in an order deemed most logical by the Company. Realizing that Federal or State inspectors may want to evaluate this report in light of Federal guidelines on report preparation, the following discussion is provided. Each section required by Federal guidelines (please see the May 19, 1980 Federal Register) is listed. A reference is provided to show where, in the Company's report, the required discussion can be found. In special cases where a discussion was not applicable for a facility, the abbreviation "NA" has been entered. Anytime "NA" is shown, a brief explanation follows.

<u>Section Required by Federal Guidelines</u>	<u>Corresponding Reference in This Report</u>
A. Evaluation of the Potential for Impounded Hazardous Wastes to Migrate to the Uppermost Aquifer	<u>Pages 24, 26.</u> _____ _____ _____
1. Water Balance of Precipitation, Evapotranspiration, Runoff, and Infiltration	<u>Please refer to the</u> <u>Appendix.</u> _____ _____

V. Review, cont'd.

Section Required by Federal Guidelines

Corresponding Reference
in This Report

- | | |
|--|---|
| 2. Characteristics of the Unsaturated Zone Underlying the Facility | <u>Page 14, Fig. 2.</u>

_____ |
| a. Geologic Materials | _____ |
| b. Physical Properties | _____ |
| c. Depth to Groundwater | _____ |
| B. Evaluation of the Potential for Impounded Hazardous Wastes Which Enter the Uppermost Aquifer to Migrate to a Water Supply Well or Surface Water | <u>Pages 14, 19, 21, 23, 26,</u>
<u>Fig. 2.</u>

_____ |
| 1. Characteristics of the Saturated Zone Underlying the Facility | <u>Pages 12, 13, 14, 18,</u>
<u>Fig. 2.</u>

_____ |
| a. Geologic Materials | _____ |
| b. Physical Properties | _____ |
| c. Rate of Groundwater Flow | _____ |
| C. Proximity of the Facility to Water Supply Wells or Surface Water | <u>Pages 13, 18, Fig. 1.</u>

_____ |

Other comments or explanation of "NA" entries: _____

VI. References Cited

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APPENDIX

to

Groundwater Assessment Demonstration Report for

Facility: Amos

Water Balance of Precipitation, Evapotranspiration, Runoff,
and Infiltration

A water balance is a Federally required part of a Groundwater Assessment Demonstration Report. Since the subject was not addressed elsewhere in this Report, space is provided here for the necessary discussion.

A water balance has been computed for the metal cleaning waste pond at this plant. It is essential to have this information when deciding whether or not to implement groundwater monitoring activities. Local precipitation, evaporation, surface runoff, and pond lining data have been considered while calculating the water balance, and these facts are described in this appendix.

Actual average yearly precipitation in the plant area, according to Climates of The States, which is compiled by the National Oceanic and Atmospheric Administration, is 40.8 inches. Ven Te Chow's Handbook of Applied Hydrology gives a value of 32.0 inches for average annual evaporation at the plant. Subtraction of evaporation from precipitation yields a net precipitation of 8.8 inches.

Since metal cleaning waste is discharged into a basin which is surrounded by dikes and constructed solely for the purpose of retaining the spent cleaning solution until treatment is completed, this pond constitutes the entire drainage area subject to discussion. The surface area of this pond is 1.15 acres. The isolated metal cleaning waste pond is completely constructed of compacted clay. Average permeability is 10^{-6} cm/sec., or

Water Balance of Precipitation, Evapotranspiration, Runoff,
and Infiltration, cont'd.

about 12.4 inches/year.

The overall water balance for the metal cleaning waste pond
can be represented by this equation:

$$Q = P - E - I$$

where Q = surface runoff from pond

P = precipitation

E = lake evaporation

I = infiltration from pond

All parameters are average annual values, and are computed over the
surface area of the pond. Units are all acre-inches. Substituting
actual values for the variables, we have:

$$Q = 46.9 - 36.8 - 14.3$$

$$= -4.2 \text{ acre-inches}$$

Since Q is a negative number, there is neither accumulation in
the pond nor excess runoff from it due to rainfall.

Appendix

Literature Cited

Chow, Ven Te, Handbook of Applied Hydrology, McGraw-Hill, Inc., New York (1964).

National Oceanic and Atmospheric Administration, Climates of the States, Water Information Center, Port Washington (1974).

Other References

Site Plans, American Electric Power Service Corporation.

Webb, T. E., Internal Memorandum, "Water Balance for RCRA Groundwater Studies", (May 1, 1981).